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ABSTRACT

Designed to assist administrators in making intelligent decisions about microcomputer selection, this nontechnical guide provides information in three areas: how, where, when, and why to use a microcomputer; what questions to ask about software and hardware; and what terminology to use. It provides a framework for answering six questions the administrator considering microcomputer selection might ask: (1) What do I want a microcomputer to do for me? (2) What software is available to meet my goals? (3) What microcomputer should I purchase? (4) What other equipment will I need? (5) Can I afford the hardware? and (6) Everything's purchased: What do I do now? A glossary explains microcomputer-related terms. Specific topics addressed range from computer assisted instruction, computer managed instruction, and word processing to documentation, memory capacity, maintenance, security, peripherals, funding sources, and staff development. Appendices include samples of software, courseware, and hardware evaluation forms, and a Teacher Education/Computer Center Map showing regional contacts in California. (LMM)

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Microcomputer Selection Guidelines For Administrators

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MICROCOMPUTER SELECTION GUIDELINES FOR ADMINISTRATORS

Sponsored by
The Research, Evaluation, and Accreditation Committee
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* "Adding a Micro to your School Picture," adapted from Electronic Learning, Volume 1, Number 3, January/February 1982, by Karen Billings and Stephen Gass, has been removed due to copyright restrictions.

PREFACE

It looks as if the microcomputer revolution has arrived!

As a result, you need to be prepared to face a steady barrage from salesmen, journals, publications, parents, students, teachers, and administrators concerning the purchase and use of microcomputers. These guidelines were prepared to assist you in making intelligent decisions about microcomputer selections.

It has been estimated that there are approximately 200 brands of microcomputers available today. Do you buy a Heinz assortment or do you stay with one company? To make a decision you need knowledge in three areas:

- how, where, when, and why to use a microcomputer
- what questions to ask about software and hardware
- what terminology to use

The first section of these guidelines has been prepared to assist you in preparing a "wish list" for computer usage. Planning to purchase a micro should include organizational concerns such as how to use the equipment, where it will be located, and who will use it. Planning should help you establish your software needs, and the software you select will eventually help you determine what microcomputers may be right for your school.

The second section of the guidelines is directed toward software and details areas you need to consider as you evaluate the software available to meet your needs.

Hardware should be the last item you evaluate, because it will need to be matched to your software. There are some general questions to ask about the hardware you are considering:

- Is there a local vendor?
- Is the product new and untested?
- Does the hardware allow for expansion?
- Is there good and well-documented software?

Maintenance, insurance, security, and staff development are other important considerations. They must all be investigated in order to determine whether you can afford a microcomputer. Many school districts may make the mistake of spending large amounts of money on both hardware and software and negligible amounts on teacher training.

While selecting a microcomputer may be a new experience for you, you need to realize that you are not breaking new ground. Talk to owners/users of the systems you are considering and see if the equipment is operating satisfactorily for them. Then use these guidelines to refine your planning and selection procedures. There are many articles in the current publications and many human resources available to assist you in arriving at decisions. The State of California has established fifteen (15) Teacher Education Computer (TEC) Centers to provide inservice training and expertise for administrators and teachers.

People, too numerous to mention, have made many valuable contributions of their time and expertise in the preparation of these guidelines. All the ACSA Regions and their representatives on the Research, Evaluation, and

Accreditation Committee were very helpful and supportive. The project committee wishes especially to acknowledge the help and support of Dr. Arthur Thayer, Assistant Executive Director, Operations, at ACSA's Burlingame Office.

WHAT DO I WANT A MICROCOMPUTER TO DO FOR ME?

Microcomputers are versatile resources. Your priorities for microcomputer utilization may be in any of several areas:

Computer Literacy [Skills]

Your goal may be to provide pupils and/or staff with that collection of skills, knowledge, values, and relationships that allows a person to function comfortably as a productive citizen in a computer oriented society. Your need for a microcomputer may focus on any of several places on a continuum of microcomputer skills, from awareness of how a microcomputer functions, to the operation of one for personal and consumer uses, to adeptness at programming in one or more of several microcomputer programming languages.

Computer Assisted Instruction [CAI]

Students should have the opportunity of interacting at a terminal with instructional material presented by a microcomputer system, usually called Computer Assisted Instruction (CAI).

Your objective may be to reinforce, remediate, motivate, individualize, personalize, or enrich instruction. CAI may be used at all grade levels and in any of a variety of different curricular areas: mathematics, reading, language arts, study skills, health, industrial arts, home economics, social studies, foreign language, business education, and fine arts.

Instruction can be optimized in one or more modes of CAI:

Drill--student responds quickly and briefly to item or question presented by the computer.

Practice--student responds to more complex computer direction possibly requiring more extensive interaction with the computer.

Testing--microcomputer records and analyzes student responses to items presented.

Tutoring or Individual Instruction--student interacts with the computer which presents textual material, frequently using branching based upon student response. Opportunities for discovery learning, problem solving, and inquiry may be provided.

Simulation--microcomputer models results and interaction of student-selected events. This is frequently used in social studies instruction.

Gaming--student pursues a winning strategy utilizing probability in responding to random events generated by the computer.

You may need specialized microcomputer assistance to compensate for a variety of handicapping conditions in the field of special education. Specialized microcomputer assistance is also available in the fields of art (graphic design) or music (composition), and language arts (word processing in creative and other writing).

Computer Managed Instruction (CMI)

A microcomputer may help you to store and revise curricula, homework

assignments, and resource lists; to record and manipulate student data in order to affect CAI; or to produce a variety of reports:

- . class profiles
- . diagnosis and grouping
- . I.E.P. tracking
- . individual pupil progress reports (grades)
- . proficiency testing documentation
- . test scoring and analysis

Occupational and Vocational Training

You may have a need to provide training programs in word processing and microcomputer programming. If you provide occupational or vocational training, you may also be concerned about occupational adjustments and the need to provide microcomputer skills such as word processing in programs as varied as business occupations and auto mechanics.

Word Processing

Microcomputers and other electronic equipment can assist in creating, viewing, editing, manipulating, storing, retrieving, and printing written material. You may have a particular interest in district and school communications, including handbooks, yearbooks, newspapers, newsletters, memos, letters, and reports. Word processing is also an excellent "writers' tool" in language arts instruction.

The Media Center

Computerizing inventories, circulation control, library instruction, bibliographies, catalog cards, and catalogs may be of interest.

Counseling - Guidance

Counseling and guidance staff may utilize the microcomputer to track pupils, to provide occupational and vocational guidance, to assist students in college selection, and/or to maintain student files.

Central and/or Site Office Management

It is often desirable to computerize administrative, business, or personnel tasks, that is, to utilize a microcomputer to store and process data. You may wish to address any of a variety of needs, including the following functions:

- accounting
- alphabetizing
- attendance accounting
- monitoring and reporting
- budget modeling and projection
- bus routing
- communications
- address lists
- mailing labels
- form letter files
- data base manipulation
- food service reports
- forecasting
- form files
- inventory control and ordering
- maintenance schedules
- payroll
- personnel files and reports
- pupil files and reports
- pupil scheduling and class lists
- student activities records

WHAT SOFTWARE IS AVAILABLE TO MEET MY GOALS?

What is Software?

The terms "hardware" and "software" date back to the earliest days of computing. Traditionally the machinery for data processing has been called "hardware," and the various applications which make that machinery perform have been called "software." In general, this section of the report will deal with those pieces of software which are required to make a microcomputer perform specific applications such as presenting a tutorial lesson or creating record files on students or word processing a letter or report.

Which comes first. . . . . the chicken or the egg?
When moving into the educational use of data processing, you might be tempted to go shopping first for a microcomputer. You would be better advised to examine what types of software are available to meet your goals before settling on any particular hardware. Educational software is not necessarily available for any one microcomputer.

Unfortunately, the world of microcomputers is populated by salespersons, each of whom is eager to tell you that his microcomputer will do everything for you from teaching your classes to preparing your records. Also, the journals are filled with articles and advertisements for software in such vast numbers that the neophyte feels caught in the middle of a maze.

Getting Started

The following suggestions are offered as a starting place for you should you wish to join the world of microcomputers:

1. Begin your search by examining the many free (public domain) materials which have been developed by and for other educators. In California, fortunately, the best place to find out about free programs (software) for microcomputers is your area's TEC center, which is funded by the State of California. The clearinghouse for TEC center information on software is in San Mateo, and there are fifteen TEC centers throughout the state. (See appendix for a map showing the locations of centers and the individuals to contact.)

   Each regional TEC center will contain both microcomputers and public domain software (software which is not copyrighted). Individuals from school districts should rely on their local centers to demonstrate the use of microcomputers, to examine (try out) software (both public domain and commercial), and to copy public domain software for their own use by providing the disks on which the programs are to be stored.

2. Refer to some of the published reviews on commercial software available for educators in such publications as:
   ... Educational Technology
   ... Electronic Learning (Scholastic, Inc.)
   ... The Computing Teacher (ICCE)
   ... Classroom Computer News

3. Check again with your TEC center for a comprehensive set of reviews of educational software. A recently completed review, prepared by a group of fifteen experts from around the United States, is titled The 1983 Educational Software Preview. You may obtain a copy of this preview from the TEC Center Software Library and Clearinghouse.

Checking Software for Documentation

When examining software for possible purchase, you need to check on the documentation which accompanies the product. The following information is essential to assure that you will be able to use the software you order.

What is the configuration of equipment (hardware) which will be required to run the software?

... What makes of microcomputers use this product?

... What are the memory requirements for the microcomputer you will use?

... Is a tape cassette required? If so, what type?

... Are disk drives required? If so, how many and what type (single density or double density)?

... What type of monitor is required (color or black and white)?

... Does this software call for a modem?

... Is a printer required?

If all of the above seem to be a foreign language at the moment, please have patience. All of the special terms used are included in the Glossary. Further you will discover a section titled "What Microcomputer

Can Use the Software" and a later section of this report titled "What Other Equipment Will I Need?" These three sections should provide answers to your questions.

Consider the Licensing of Software

In many cases, software may be purchased under a licensing arrangement with the publisher. In this instance, the buyer (usually an organizational unit the size of a school district) contracts with the publisher to purchase a license to use a particular program in many different classrooms. After paying the licensing fee, the buyer pays only the cost of the blank disks (or cassette tapes) for each copy. In some cases the publisher supplies the master disk and allows the buyer to make his own copies.

If you are considering this option, you should weigh the relative costs of the license and the cost of blank disk costs against what it would cost to purchase the required number of copies of a piece of software. REMEMBER, IT IS ILLEGAL TO COPY SOFTWARE WITHOUT THE CONSENT OF THE PUBLISHER.

A Few Notes on the Appropriateness of Materials

Many educators who have struggled with the process of selecting educational software for microcomputers have discovered that it is difficult to identify the educational objectives of a specific piece of software. By using the publications and sources cited above, you may gain some helpful information on specific pieces of material.

Additionally, when you buy software for instructional purposes, you should consider any potential purchase in terms of how such materials will help in reaching the objectives of your school's (district's) curricular continuums.

Now.....Back to the Chicken or the Egg Issue

The following section of this report will discuss the various options of microcomputer hardware. It would be advisable to read through the balance of this report before running out to buy software for an anticipated microcomputer. The important thing is to consider software first, and then, armed with a clear idea of the types of things you wish to do with microcomputers, look at the hardware which will run your "dream" programs.

At the present time, educational software has been written for those microcomputers which existed and which educators had on hand. Be aware that the picture changes every day, and that software which was once only available on Microcomputer "A" may now be written and available for Microcomputers "C", "D", and "E."

Do not, however, conclude that one of those "computer nuts" in your district (teacher or student) will be able to rewrite an existing piece of software for a system other than the one on which it was designed to run. As a matter of fact, some of the competitors of the most popular microcomputers (APPLE's imitators, for example) will claim that their software will run on the APPLE microcomputer and vice versa. This may or may not be the case. It is always better to purchase software which is

microcomputer compatible with the majority of software which you intend to use.

Finally. . . . A Parting Word on Software for after You Buy that Micro

Districts purchasing software from commercial vendors should be aware that many (soon most, it is hoped) responsible vendors make arrangements for schools to take software on approval. Often a thirty day approval period can be arranged. One caution, however, to school administrators: don't "kill the goose that laid the golden egg" by allowing members of your staff to pirate (copy) software taken out on approval. This is illegal. Further, when software is taken on approval and it is not purchased, the individual returning the material should inform the vendor in writing of the reasons for returning the materials. This is just common courtesy.

What Microcomputer Can Use the Software?

You have discovered by now (assuming you have been a careful reader) that microcomputers and software need to be mated in order to run the programs which you buy. There are so many microcomputers now sold in this country that a discussion of each would be beyond the scope of this report. To assist you in looking for hardware, the following suggestions are offered.

Originals or Clones?

A number of popular microcomputers have been cloned (copied), and the salespeople handling these clones will assure you that all of the software written for the popular original will run on their microcomputer. Alas, this is not always so! Many of the purchasers of clones have found that annoying little bugs crop up in running programs, sometimes making use of the software impossible.

Where Do I Go for Help?

Your regional TEC centers are a good place to obtain advice for the purchase of a microcomputer to match your software. In most cases they will have demonstration models for most of the popular microcomputers in the center for you to try out.

The software documentation should also specify the type of microcomputer which you will need. If it does not, beware of the software.

What are the Factors Which Make One Microcomputer Different from Another?

The major variables for microcomputers include (1) the method for saving (storing) programs, (2) memory capacity, (3) the operating system, (4) the visual display, (5) the languages which the microcomputer can use, and (6) the keyboard.

Method for Storing Data

To make a piece of software operate, you must enter it into the microcomputer. The simplest "bare bones" microcomputer sold might not have any external storage system. In such a case you would have to type in the program instructions for an application each time you used the device -- a very time-consuming process. In general, three types of external storage are available for microcomputers:

1. Cassette Tape

   Many of the cheaper versions of popular microcomputers allow you to enter prerecorded programs only via the medium of a cassette tape recorder similar to the type you would use to record music or a conversation. This system is usable, but the amount of time required

to enter (or to record) programs takes from fifteen to twenty seconds up to five or more minutes.

If your software is only available on cassette, then you should look at this system of program storage and retrieval.

2. Floppy Disks

Most software is currently stored on five and one quarter (5 1/4) inch floppy magnetic disks. Practically any popular microcomputer which can be purchased with cassette tape input is also available with disk drives which accept floppy disks. The cost of this option (per disk drive) may increase the total price of your microcomputer by $150.00 to $500.00; however, the expense may be justified in the amount of time saved in loading and storing programs.

3. Plug-in Cartridges

Certain microcomputers are equipped with plug-in modules (cartridges) which contain software. At the current time it is possible only to <u>enter</u> programs to microcomputers from plug-in modules. A program written on the microcomputer <u>cannot be recorded onto a plug-in module</u>. If the software you are considering is only available in plug-in modules, then you have no other choice for this software. There might be instances where you would not need a recording capacity and where this type of system would be acceptable for your uses.

Memory Capacity

The smallest microcomputer today contains an internal memory capacity larger than that of many "large" computers of twenty-five years ago. The micro-miniaturization technology of today has brought about this change. In general, the memory capacity of a microcomputer will vary from a low of about 16,000 bytes (often written as 16K) up to capacities exceeding 500,000 bytes (500K). You do not need to understand the technical nature of a byte to make decisions concerning the purchase of a microcomputer, but you should know that a byte is the space required to store one letter or number.

First of all, look at the documentation on the longest program which you intend to run on your new microcomputer. This documentation should specify the number of K-bytes required for operation. Use this as a base to determine the general amount of memory which would be required for your purposes and then obtain one other important bit of information about the microcomputer you are considering. Does it require some of its memory for operating in the language in which the program is written? If so, you will need to add whatever space is required for such a purpose to the requirements of your longest software package in order to ensure adequate memory to run that program. The following (hypothetical) example might be helpful: You intend to purchase a program entitled "Math Aids." The documentation states that you need the following capability to run the program:

... 1 disk drive

... 32 K-bytes of memory

... The BASIC language (the program is written in BASIC)

You are considering a microcomputer which runs the BASIC language and which has a memory capacity of 48 K-bytes; therefore you are safe in assuming that the program will run on this microcomputer.

MAYBE YES --------- BUT THEN IT COULD BE NO!

The hidden factor is the method in which your microcomputer will run the BASIC language. If, as is true in some cases, your microcomputer requires 18 K-bytes of memory to run BASIC, you have a problem. Our arithmetic shows that 32 + 18 total 50.

- - - - TILT! - - - - -

The computer you are considering will only handle a total of 48 K-bytes. IT WILL NOT RUN THIS PROGRAM.

Obtain the help of someone knowledgeable in microcomputer capacity in making a decision such as the one posed in the above example. Perhaps your local TEC center can help you.

Operating System

If you are considering a program which utilizes disk drives (or plug-in modules), then a major consideration is the operating system of the microcomputer you will buy. There are two popular operating systems in use at this time. They are DOS (Disk Operating System) and CP/M (Control Program Microcomputers). The software packages you buy should include documentation on which type of operating system you will need because the two systems are not interchangeable.

It is possible, however, that a given microcomputer can run on either system. (Many do.) Now we are back to that basic problem in microcomputer memory. In many cases an operating system requires some of that memory space because it is actually entered into the computer from a floppy disk before a program is entered . If this is true, then the memory capacity for your intended microcomputer should be large enough to handle the length of the longest program you will be running plus the space which may be taken up by the language used plus the space which may be required to load an operating system.

In the case of plug-in modules, your choice is more limited. In general, program modules only operate on the single microcomputer for which they are prepared. Most cannot be physically plugged into any other microcomputer.

Visual Display

Until the time arrives when you can talk to your microcomputer and that microcomputer answers you back, the visual display is an important consideration in purchasing a microcomputer. The variables here would be size, color, and method of connection.

Color is nice but more expensive than a monochrome display. Size is also related to cost -- the larger the screen the higher the cost. A more subtle difference, and a more important one, is the method of connection between the microcomputer and the display. If the microcomputer is said to operate through any television set, then the quality of the picture will be considerably less crisp than if the display is one of the "monitor" type

which receives its picture directly from the microcomputer through wires. There is no better way to choose a display than to observe the microcomputer operate on the type of display you intend to use. If you can do so, it would be wise to look at both types of display side-by-side in a microcomputer store (or at your TEC center) to assist you in making a decision.

If the documentation of the software you intend to purchase includes color as part of its operation, then you must have a color display to operate such a program. Some programs operate either in color or in monochrome. In such a case, try to look at the program on both types of displays before making a decision on purchase.

One hidden factor related to the display is also a function of the microcomputer itself. That is the capability to do graphics. If the software package states that the program contains graphics, then you must be certain that the microcomputer you purchase will include the capability to handle graphics and that the graphics produced look acceptable on the display you select.

Languages Which Your Microcomputer Can Use

The term BASIC has already appeared in this section of the report. This is the most common language for microcomputers. However, the actual language spoken by any computer, whether large, mini, or micro, is its machine language. Machine language is a set of codes, numbers and letters, which tell the computer what to do. Fortunately for the user, knowledge of machine codes is not necessary to operate a microcomputer.

There is a consideration here, however, which relates to the speed at which a microcomputer will operate. Machine language is always much faster than a so-called high level language like BASIC. Therefore, software which you purchase, which matches your computer, and which runs in machine language will run faster than programs in BASIC. The amount of time required, for example, between a question asked by a microcomputer, the student's response through the keyboard, and the next response from a microcomputer will generally be much shorter with a program written in machine language than one in a language such as BASIC.

The language involved, however, is not negotiable with software. A software program will run on the proper microcomputer and only in the operating system and the language in which it is written. Be sure to check the documentation for these details in purchasing a microcomputer or in buying software for an existing microcomputer.

Keyboard

A final consideration in c ing a microcomputer is the type of keyboard which it uses to enter information into the computer. There are basic differences among the various keyboards in use today. Most (if not all popular makes) use a typewriter layout for the letters. Beyond that some important differences exist. One is size and the other is related to touch.

In the first instance, keyboards run all the way from miniature units up to full-sized typewriter keyboards. Beyond the size, there are two entirely different types: the membrane keyboard and the movable keyboard. The membrane board is a flat surface which is operated by applying slight

pressure to the areas which represent letters. The movable key type is similar to an electric typewriter keyboard. To decide which keyboard is best for you it might be profitable to ask both teachers and students to try out the various type of keyboards before making a final selection.

Cost Factors

Of course, you can purchase the cheapest configuration of a computer with the idea of expanding its capacity later. This is generally possible, although you may spend more money in the long run. The experiences of those who started with the smallest unit and then expanded later have shown that a configuration of a given size is usually cheaper when purchased at one time than in add-on parts.

The best approach is to buy the microcomputer which best matches your needs and one which you can live with for the next several years. A careful choice should provide you with a system which will work effectively for three to five years without major additional expense.

Capacity of Floppy Disks as a Restriction

Individuals wishing to use a microcomputer for managing large files such as inventories, textbook titles, and student attendance should be familiar with the limitations of 5 1/4" floppy disks. Most of these disks can handle about 150K (150,000) bytes of data.

The number of records and the length of each record will determine the amount of information which can be stored on such a disk.

A rule of thumb says to subtract 8 K-bytes from the disk's capacity for the necessary index which it must contain to find the stored data. This means, for example that one 160K disk can really store a total of 152 K-bytes of data. The length of each record divided into this figure will give a rough estimate of the number of records which it can store. Consult someone familiar with data storage to assess accurately the amount of space your data will require.

If the data requirements are impractical for the use of small floppy disks, then the user might consider the use of the new hard disks for microcomputers.

WHAT MICROCOMPUTER SHOULD I PURCHASE?

There are almost two hundred different brands of microcomputers available today, so don't be alarmed if what you thought would be a simple project now appears to be a major headache. Which microcomputer is right for you is not a simple question. The purpose of these guidelines is to present an approach for selecting a microcomputer rather than to recommend a specific machine.

So far you have completed two major steps toward selecting the microcomputer that is right for you. First, you identified why you want a microcomputer system, and second, you identified the software package/s that will allow you to perform those tasks.

Your task now is to identify what computers will run your software, can be programmed to meet your needs, and are priced within your budget. You will find that micro prices range from a few hundred to a few thousand dollars, so make your comparisons carefully. When you compare prices, look at systems with comparable components, e.g., a computer, monitor, dual disk drive, and 48K memory. 48K refers to bytes. A byte is the computer space needed to store one letter or number, and K is 1000. A microcomputer with 48K memory can store 48000 characters. Also consider the future expandability of the equipment you purchase. Initially you don't want to buy more computer than you need, but you do want to establish that your system can be expanded to meet your future needs.

The following items should be covered as you evaluate the computer systems that seem to meet your needs.

Memory

Look at the software package/s you identified as most appropriate. What memory capacity does each package require: 32K, 48K, etc.? The computer you buy must have at least the amount of memory required by the software you plan to use on it plus the memory required by the computer language plus any memory required for the program operation.

Ease of Use

Can you use the system with a minimum of training? Are the printed materials explicit enough to tell you what to do step by step?

Reputation, Maintenance, and Service

Since the field of microcomputers is rapidly expanding and changing, look carefully at the reputation of the manufacturer and the dealer of the equipment you are considering. Are you confident that they will stand behind their product and be available when your equipment needs maintenance and/or service?

Other things to ask about include the availability of service contracts, whether the equipment can be serviced at your site and whether routine maintenance can be done at times when you are not using the equipment.

The application for which you are considering a microcomputer will help you narrow your hardware selection. As you begin to evaluate hardware remember the following guidelines for each application.

CAI/CMI

Try to observe the use of the hardware and software you are considering in school locations which are similar to yours. This will be the best indicator of how the programs and equipment will work for you. A general rule of thumb is that computerizing school functions should be more efficient and less costly than what you are currently doing.

Programming

The level of programming being taught and the languages used for instruction are important considerations. Determine if your objective is to teach programming logic or languages. If you are concerned with languages, you will need hardware that can handle multiple languages. You will also need to look at the levels of programming classes you plan to offer-- beginning, intermediate, and advanced. As students advance and write increasingly complex programs, they will require more usable memory.

Computer Science

If your objectives include teaching students data processing systems and concepts, you will need a microcomputer that uses Pascal, COBOL, and/or FORTRAN.

Administrative/Management Functions

If your primary objective for purchasing a microcomputer is to computerize office functions, look for integrated systems. You want to be able to input a student data base and access it for multiple purposes: programming, grade reporting, envelope addressing, etc. You do not want to have to input the student data more than once.

Word Processing

If you plan to use your system for word processing, you will need equipment that has a typewriter style keyboard, a reasonably high character count per line, upper and lower case capabilities, and a minimum of 48K memory.

One final consideration--Do you buy a Heinz assortment or do you stay with one company? Again, look at your objectives. If you are purchasing the equipment for administrative, management, or word processing applications, you may want to buy one brand, so that your staff will be able to use the equipment efficiently. If you are going to use the equipment for instructional purposes, you may be well advised to buy a Heinz variety. Your students will be working on many computers during their lives, and the greater their exposure to a variety of equipment and programming languages the better prepared they will be.

WHAT OTHER EQUIPMENT WILL I NEED?

When you have identified the computers that are available to perform the tasks you desire, there are several other pieces of equipment you will need to consider. We're going to look at these in three groups: peripherals, networking equipment, and furniture.

Peripherals

Peripherals are auxiliary equipment you will need to enable your computer to perform the tasks you outlined. Peripherals may include disk drives, printers, modems, paddles, joy sticks, light pens, voice synthesizers, and graphic plotters. The peripherals may cost more than the computer, so plan carefully for all the equipment you will need and budget accordingly.

1. Disk Drives and Audio Cassettes

Audio cassettes or floppy disks are used to store the programs and information you will use on your computer.

An audio-cassette drive involves plugging your computer into the microphone jack of a tape recorder and using a cassette tape to store programs and data files. Information written from the computer's memory is stored on tape. The information is read back into the computer memory by plugging the earphone output jack into the computer.

A floppy-disk drive is more like a cross between a tape recorder and a record player. The computer writes information onto a disk which rotates like a record, and there is a "tone arm," which is able to move to any place on the disk surface. Disks are the preferred medium for storage.

The cost of disk drives increases as you increase the density (number of characters) that can be written on a disk. A single-density 5-inch disk holds about 80K bytes. A single-density 8-inch disk holds about 250 K-bytes. The amount of disk-storage on-line you will need depends upon what you will be doing. You need to estimate your storage requirements and plan for growth.

A second disk drive does more than increase the storage capacity of your system. It enables you to copy files from one disk to another for backup purposes. (Backup means to copy a file or program onto a disk or tape and to save it to use as an alternate in case a system failure destroys a file with which you are working.)

2. Printers

If you want to make paper copies, you will need a printer. There are two basic types: dot-matrix and formed-character. When a dot-matrix printer is used, each character is made up of a pattern of dots. A formed-character printer works like a typewriter. Formed-character printers are slower than dot-matrix printers, and they are much more expensive. If you are going to use your system for writing letters, preparing proposals, or creating camera-ready copy for printing, you will want a formed-character printer. Most of your maintenance problems will be related to your printer, so select it carefully.

Other things to consider before purchasing a printer are paper quality (does the printer require chemically treated or thermal paper) and the manner in which paper is fed through the printer (tractor feed versus single sheet feed).

3. Scanners

There are two basic types of scanners: optical character readers and optical mark readers. Either scanner is used to put information into a computer.

An optical character scanner reads typed copy into the computer.

An optical mark scanner reads marks such as bubbles on an answer sheet into the computer. If you plan to use your computer to score tests, you will probably want to purchase some type of optical mark scanner.

4. Modem

A Modulator/Demodulator may allow your computer to communicate with other computers over the phone lines. If you want to be able to access information on a district computer, you will need a modem to do this.

5. Light Pens

Light pens can be used with some computers. These allow students to respond to items on the computer's display screen by flashing a light on their desired responses. Light pens may also be used to read printed symbols and enter them into the computer. (Many department stores use light pens attached to their computerized cash registers to read price and inventory information.)

6. Paddles and Joy Sticks

These are auxiliary hardware used for playing computer games. They are the pieces used to move players, return balls, direct asteroids, etc. on computer, video games.

7. Speakers/Voice Synthesizers/Color

Equipment may be added to some computers that enable them to produce speech or music. Computer color capabilities range from black and white to full color. To use the sound or color capabilities you will need to purchase sound generators, voice synthesizers, or expander cartridges.

8. Expandability

When you have selected a computer that fits your present needs, determine whether the system can be expanded to fit any potential future needs. Expansion may be done by adding additional disk drives, using expander cartridges, etc.

Network Equipment

If you are going to use the computer for instructional purposes either to provide computer assisted instruction or to teach programming, you should consider the equipment's networking capabilities.

.Can you link several microcomputers to a teacher control terminal? Doing this allows the teacher to enter information onto each student's computer and to monitor what each student is doing. If your goal is to have a microcomputer lab that will accommodate a full class, you will want to be able to network twenty-five to thirty microcomputers.

If you are going to build a network system, you will need to purchase a control center and cables. The cables are used to connect all the parts of your system. These are additional expenses, and you will need to build them into your budget.

CAUTION: When you have put together your system (computer, peripherals, and network equipment), your vendor should guarantee that the whole system is working before you pay for it.

Furniture

When you know what hardware you are purchasing, there is an additional item to consider: furniture. Since you are investing in expensive equipment, do not try to economize on furniture. Furniture currently in your school should not be used unless you determine that it is safe and appropriate for the equipment. One school decided to place a printer on a surplus typewriter table rather than spend $100 for a printer stand. This decision cost them several hundred dollars, when the printer was knocked off the table and required extensive repair.

Since you will want to make maximum use of your system, look at all the ways you might use it before selecting furniture, e.g., a computer desk may serve your primary objective of computerizing office management, but a mobile computer center cart may also allow you to provide some computer assisted instruction time, since the equipment could be moved to a different location.

You are now ready to examine the most important aspect of your decision-making process. You know what you want a computer to do for you, and you know what software and hardware you need, but can you afford the system?

CAN I AFFORD THE HARDWARE?

A recent article on accepting a computer as a gift was entitled "Look That Gift Horse in the Mouth: It May Be Trojan." The purchase price of your computer and auxiliary equipment is only a fraction of what your system may cost. Make sure that your school can afford all the hidden costs before you commit yourself to purchasing or accepting a computer. Before looking at these costs, however, you will need to look at the funding sources available for purchasing the computer equipment.

Funding Sources

There are two questions you need to consider: 1) How will you pay for the initial purchase and installation of the equipment? and 2) What funds will be available for the continuing support, maintenance, and expansion of the system?

Possible sources of funding may include

- Current budget
- Categorical aid programs
- School fund raisers (parent groups and/or student body)
- Private enterprise
- Business/industry
- Savings that may result from computerizing management tasks

In addition to looking at the cost of purchasing your system, be sure that you examine the budgetary implications for installing the equipment. The following is not intended to be an exhaustive list of cost areas for

installing a computer system. It is hoped that the list will alert you to the breadth of items you should consider before deciding to purchase your equipment.

Housing

Will you need to budget for alteration and improvement (A & I) costs? These might include

- Structural alterations
- Electrical circuit and outlet installation
- Telephone line installation

Security

How will you provide for the security of your new equipment? Items to examine here include both A & I and continuing costs.

Will you need to do any of the following:

- Install security screens on windows,
- Rekey locks, or
- Bolt the equipment to table tops?

Also consider your options. If you put the system in a second floor room, can you eliminate or minimize the expense of security screens?

Staff Development

You want to be sure that staff members receive training so that the computer will be appropriately used. This training may result in additional expenses, so don't overlook examining the budget implications of your proposed staff development program.

- Do you have a staff member capable of operating the system and training others? Is there a back-up person who is able to assume the responsibility of supervising the operation?
- Is a training program available for teachers and aides? Will the vendor provide this or will it be an additional expense?
- Will you need to purchase additional users' manuals or other materials for the training program?

Maintenance

As you consider maintenance costs, you need to look at both your software and hardware.

Software

- Is there a warranty period?
- Will the company update the software or is there an additional charge for this?

Hardware

- Does your guarantee include parts and labor?
- Is service available locally, and what does it cost?
- Is regular maintenance available at times when you will not be using the system or will you need to interrupt your program when maintenance is required?
- Will the vendor clearly spell out maintenance rates and procedures in your contract?
- Does the vendor provide on-site service, carry-in service, or both?

Insurance

You will be investing quite a bit of money in your computer system, even if you decide to purchase only one microcomputer. How will the equipment be insured? How will insuring it affect your school's or district's insurance rates? Will you be responsible for paying any additional insurance costs?

CAUTION: Don't overlook checking for any district requirements related to purchasing computer equipment. Does a committee have to review your purchase plan? Will you incur any costs in addition to those covered above because of requirements specific to your district?

EVERYTHING'S PURCHASED: WHAT DO I DO NOW?

At this point you know what you want a computer to do. You have identified the software package/s, hardware, and peripherals you will need to perform the tasks you want done. You know what physical improvements will have to be made to install the equipment, and you know how you will fund a staff development program to train people to operate the system. Best of all, you know that you can afford the purchase, installation, and maintenance of the system. What else needs to be done?

Plan for Staff Development

Some people are afraid of working with a computer. Their fears may not seem reasonable, but they are very real. If you want to insure the success of your staff development program, begin with people who are interested and want to get involved. Among those interested identify who will receive inservice training. You will also want to determine who at your school is already computer literate. Consider including community members, parents, students, aides, teachers, and administrators in any surveys you conduct.

Establish the needs of those who will be inserviced. The needs will reflect the level of computer literacy your program will require. Three basic levels to consider are an awareness level, an operational level, and a competence level.

Define the inservice goals and the specific objectives/activities for the program.

Identify who will provide the inservice. You may use computer literate people at your school, district experts, county consultants, vendor or private consultants, college/university personnel, and/or TEC center personnel. In addition to identifying the people to implement your plan, you will need to identify the materials, hardware, and software that will have to be available.

Plan an evaluation process to measure the effectiveness of your inservice program.

Plan for when and how you will expand the inservice program, if appropriate.

Determine ways to support an ongoing staff development program. Some suggestions for ongoing support include

- Subscribing to computer magazines, periodicals, and newsletters
- Sharing articles from any publication that deal with educational computer usage
- Joining local computer clubs
- Working with local computer stores
- Participating in computer conferences, workshops, and courses

Plan for Scheduling/Use

Once your equipment is installed, you will want to make maximum use of it. Look at what you want the computer to do, and plan the schedule and time needed to accomplish your objectives. The time required to complete

tasks may initially take longer, so consider this in your scheduling.

If you are using the system for office management tasks, determine who will have priority for using the equipment. Who will be responsible for revising priorities when conflicts occur?

Is it feasible to use the equipment for other purposes, e.g., if office management tasks are usually completed during the morning, might the system be used for instruction during the afternoon?

If you are purchasing the system for instructional purposes, some things you might want to consider are

- Is there a way to plan access for all students?
- Can programming class schedules include lab and lecture sessions with other classes using the equipment for CAI on programming class lecture days?
- Will all students have equal access to programs using the equipment?
- Will you begin the program with one grade level or department? If so, how and when will you move to other levels or departments?

Plan for File Security

If you are using your system for office management tasks and students will also use the computer, you will need to plan for file security. How will you insure that students do not get into the data files? The options for doing this vary, so discuss your needs with your vendor. Options you have may include removing a floppy disk, changing a hard disk, linking terminals to specific disks, and/or using a secure access

code on certain files.

Plan for Supervision

Who will supervise the computer's use? Who will be responsible for

- Scheduling usage,
- Checking out equipment,
- Scheduling maintenance,
- Arranging repairs, and
- Providing assistance to all users?

Plan for Software Retrieval/Storage

The best planned system will be useless unless you can efficiently retrieve the software. Where and how will your software be stored? How will it be cataloged? (Don't overlook the possibility of cataloging your software on a computer file.) If you store your software in a retrieval room, how will the disks or tapes be protected while they are being carried from the retrieval room to where they will be used? Molded plastic mailers, disk carriers, or library cases may be appropriate to use. The disks may be stored in your retrieval room in desk stands, albums, diskbank boxes, disk files, hanging files, or flip sort files. Think about your disk storage in the same way you did furniture. This is not the time to economize, if by doing this you risk damaging your software.

GLOSSARY

address . . . . a way of identifying any location in the memory of the computer

algorithm . . . a step-by-step plan or procedure for solving a problem

ASCII . . . . . an acronym for American Standard Code for Information Interchange. A code in which a particular byte represents a character or symbol of a computer keyboard

backup . . . . an extra copy of software, normally kept on file in case the original program is damaged or lost

BASIC . . . . . an acronym for Beginner's All-purpose Symbolic Instruction Code. A computer language used in most microcomputers and often used in mainframes and minicomputers

batch processing . . an approach to data processing where a number of similar input items are grouped for processing during the same machine run. It is generally associated with one person using a computer at a time, as contrasted with timeshared computing

baud . . . . . a rate of information flow. Given in bits per second (bps), the rate is the highest number of signal elements (bits) that a device is capable of transferring in one second between two devices. Alphabetic characters, for example, being transferred at 300 baud corresponds to about 30 characters per second. Common baud rates are 110, 300, 600, 1200, 2400, 4800, and 9600 bps.

binary digit . . . . known most commonly as a "bit," a binary digit is either a 1 or a 0. Taken together, a number of bits are used to represent data inside a computer (see byte)

bit . . . . . same as binary digit

bootstrap . . . a piece of software, usually stored permanently in memory, that activates other pieces of software in order to bring the computer from "off" into readiness for use

branch . . . . . a place in a program where a choice is made to depart from the normal sequence of program instructions. The departure is made by a "branching instruction" in the program. A branching instruction may be one of two types: conditional or unconditional. In BASIC, an example of the first type is: IF.....THEN; of the second type is: GO TO

bug . . . . . any mistake in a computer program

buffer . . . . an area in the computer's memory used to store information temporarily. When using a printer, you need a buffer because the printer operates much more slowly than the computer

bus . . . . . a physical connection of parallel wires providing a communication line along which data can be sent. Usually shared by several parts of the computer

byte . . . . . a sequence of bits that represents a single character. In most small computers, a byte is eight bits

card reader . . . . an input device that transfers data from punched cards to the computer's memory

cassette tape . . . . . a strip of magnetic material on which computer programs are stored in the form of magnetic impulses. Used with a tape recorder as an I/O device for microcomputers

central processing unit (CPU) . . the part of a computer system that processes information. Its two main parts are the arithmetic/logic unit and the control unit

chip . . . . . a generic term for an integrated circuit, a single package holding hundreds or thousands of microscopic electronic components. The term comes from the slices (chips) of silicon on which they are composed

circuit . . . . a path through which electricity flows

clock . . . . . a device, inside the computer, that times events and keeps them coordinated. It also controls the rate at which information is processed, a rate sometimes measured in nanoseconds or jiffys (1/60 of a second)

COBOL . . . . . an acronym for Common Business Oriented Language. A computer language used for business applications

compiler . . . . a piece of software that takes a series of commands written in a high-level language and translates them into a lower-level language more efficient for the computer to use

code . . . . . the relationship between bits and a set of characters. Microcomputers deal only with bits when executing a program. Therefore, letters, numbers, and other human understandable characters must be translated into bits. Each character has a bit code representation. The most commonly used code is that known as ASCII. Code is sometimes used as a synonym for program. For example: one may say that a programmer generates code

computer . . . . a machine designed to accept information, store information, process information, and give out processed information

Computer Assisted Instruction (CAI) . . . . . the use of a computer to help present instruction, to help teach students. This includes routine drill and practice, use of programmed instruction with multiple branchings depending on student answers, and sophisticated interactive systems designed to teach high level skills in problem solving

Computer Managed Instruction (CMI) . . . . . the use of computers as a record keeper, diagnostic tester, prescriber of what to study next, and so on. The main goal is to help automate some of the management aspects of instruction

computer program . . . . a series of commands, instructions, or statements put together in a way that tells a computer to do a specific thing or series of things

courseware . . . a combination of software, print materials, and other aides for the student and teacher

CP/M . . . . . Control Program Microcomputers

CPU . . . . . Central processing unit. The heart of a computer that controls all operations of all parts of the computer and does the actual calculations

CRT . . . . . Cathode-ray tube. A TV-like display used with most small computers to show the information the computer has output

cursor . . . . . a position indicator on a CRT. It's normally a flashing or nonflashing square or rectangle

Daisy Wheel Printer . . . . a printer which has a wheel mechanism, with characters on the perimeter of the wheel. The wheel rotates to place the appropriate character in print position. A "hammer" strikes the character, forcing it against a ribbon, thereby forming an impression on the paper. The daisy wheel printer has the reputation of great reliability, it is relatively inexpensive, and forms a solid character on the paper

data bank . . . a collection of computerized information that is usually stored on I/O storage devices such as tapes and disks

debug . . . . . correct errors in a computer program

disk (disc) . . a record-like magnetic-coated piece of material that can store programs, data or tables of information. The process is similar to storing musical information on a magnetic tape. Commonly found are floppy and hard disc systems

disk drive . . an I/O device that loads a program or data stored on a disk in a computer

DOS . . . . . Disc Operating System. A collection of programs which are the operating system (OS) for a disc drive

downtime . . . . the amount of time a computer is out of operation due to a system malfunction

dot matrix . . . a method of generating characters by converting the ASCII code into a suitable group of dots arranged in a 5 X 7, 7 X 9, or other suitable patterned array

emulation . . . a process by which some computers can run programs not specially written for them

floppy disk . . a magnetic storage device commonly used with microcomputers

flowchart . . . a diagram showing the sequence of steps in an algorithm or program

FORTRAN . . . . an acronym for FORmula TRANslator. A programming language commonly used for scientific engineering applications

gigo . . . . . garbage in, garbage out. Implies that misinformation applied to the CPU will result in misinformation output

handshaking operation . . . interaction of the central processor and interfaced devices which requires the device to signal the processor as each command occurs during data transfer. This operation is performed by modems or terminals to verify that channels are cleared and that operations can proceed

hard copy . . . paper output from a printer; printout

hard disk . . . a magnetic storage device commonly used with minicomputers and mainframes

hardware . . . . computer machinery

high-level language . . . a programming language such as BASIC, PASCAL, or FORTRAN, that is designed for a particular use. It must be translated to machine language by a compiler or interpreter

input . . . . . information to be put into the computer

integrated circuit (IC) . an electrical pathway, made up of many transistors, that transmits electricity much faster than a single transistor. Integrated circuits were used in third-generation computers

integrated circuit chip (ICC) . . a very tiny wafer of silicon containing thousands of integrated circuits. Chips are used in fourth-generation computers

interface . . . attach two or more pieces of hardware

interpreter . . a program in ROM (Read Only Memory) that translates each statement of a high-level language into a machine language instruction

I/O . . . . . input/output

K . . . . . stands for kilo or 1,000; used when referring to memory size, such as 16K bytes

log on . . . . . make contact with a computer via a terminal

LOGO . . . . . a computer programming language developed by Seymour Papert specially for children. It is an excellent language to use for introducing computers into the elementary and secondary school classroom

mainframe computer . . . a large computer system that can handle many jobs at once

memory . . . . . the part of a computer system that stores information

menu . . . . . a listing that allows the user to select a program or part of a program

microcomputer . a small desktop computer that can do one job at a time. It is also called a home or personal computer

minicomputer . . a medium-sized computer system which can do several jobs at once

modem . . . . . an electronic device that allows computer equipment to send and receive information through telephone lines

mouse . . . . . a device that positions the cursor

nanosecond . . . one billionth of a second. It is used to measure computer speed

noise . . . . . refers to inaccurate data transmission. This causes typographical errors in output

optical mark reader . . . . an input device that reads markings on paper

output . . . . . the results of a processed program

Pascal . . . . . a computer language, named after Blaise Pascal, used in microcomputers as well as larger systems

peripheral device . . . . a device, such as a printer, mass storage unit, or keyboard, which is an accessory to a microprocessor and which transfers information to and from the microprocessor

peripheral equipment . . . hardware, such as a tape recorder or printer, that is connected to the main computer

port . . . . . the two most common types of ports are RS232 and 20ma (read twenty millamps). These ports are frequently referred to as I/O ports (input/output ports) and are the connections through which the computer communicates with the outside world. Thus, ports are the "plugs" which connect the computer to peripheral devices such as keyboards and printers

printout . . . . the output from a printer. It is also called hard copy

Random Access Memory (RAM) . . . . the computer's temporary n[illegible]. It stores data and programs that are input

Glossary (Cont'd)

Read Only Memory . . . . the computer's permament memory

scientific notation . . . a shorthand for very large or very small numbers. On a computer, 6.987E+09 stands for 6,987,000,000

scrolling . . . a technique of displaying data on a CRT screen. Each line of data appears first at the bottom and moves upward as new lines are displayed. Eventually the line disappears off the top of the screen

software . . . . programs for a computer. Usually refers to programs stored on devices such as disks or tapes

syntax error . . an error in the structural rules of a programming language. It is usually an error in spelling or punctuation

terminal . . . . an I/O device that has a keyboard for input and either a video screen or a printer for output. It is connected to a mainframe or a minicomputer

timeshared computing . . . a form of interactive computing in which a number of terminals are connected to a single computer system and share its resources. The system can be designed to allow easy communication among the users. Typical applications are airline and motel reservation systems, stock market quotation systems, and multi-user interactive instructional computing systems.

video screen . . an output device used to display information. It is also referred to as a cathode ray tube (CRT) or monitor

word processing . . the ability of a computer to allow the user to move or change words, sentences, and paragraphs without retyping them

APPENDIX

This appendix contains samples of software, courseware, and hardware evaluation forms. If you find that these forms do not meet your needs, check with your TEC Center and in recent educational computer usage publications for others.

"Adding a Micro to your School Picture," adapted from Electronic Learning, Volume 1, Number 3, January/February 1982, by Karen Billings and Stephen Gass, has been removed due to copyright restrictions.

SOFTWARE CHECKLIST

Name of Program: Cost:

Supplier:

Subject Area: Type of Application:
(Tutorial, simulation, etc.)

Documentation:

Medium:	No. of:	Program Language:
_ _ _ Cassette Tape	_ _ _ _	_ _ _ _ BASIC
_ _ _ Disk	_ _ _ _	_ _ _ _ MACHINE
_ _ _ Plug-in Module	_ _ _ _	_ _ _ _ OTHER _ _ _ _

Memory of Microcomputer Required:

_ _ _ No. K-Bytes for program _ _ _ No. K-Bytes for Files (if any)

_ _ _ No. K-Bytes for Operating System &/ Program Language

Total Microcomputer Memory Requirement= _ _ _ _

Back-up Protection

Can program be copied? _ _ _Yes _ _ _No

If "No" does supplier provide back copy(s)? _ _ _Yes _ _ _No

Cost: $ _ _ _ _ _ _

Other Program Requirements

_ _ _ _ Color Monitor	_ _ _ Graphics
_ _ _ _ Printer	_ _ _ More than 1 disk drive
_ _ _ _ Light Pen	_ _ _ Joy Sticks/Paddles
_ _ _ _ Mouse	_ _ _ Voice synthesizer
_ _ _ _ Other (_ _ _ _ _ _)	_ _ _ Other (_ _ _ _ _ _ _)

Are Updates Provided by the Supplier? _ _ _Yes _ _ _No

$_ _ _ _ _ _ _ Cost (if any)

_ _ _ _No. of Copies Provided

Is the Manual (Set of Intructions for Running Program) Satisfactory?

_ _ _Yes _ _ _No Can it be legally copied? _ _ _Yes

_ _ _No

Additional Comments:

microSIFT COURSEWARE DESCRIPTION

NORTHWEST REGIONAL EDUCATIONAL LABORATORY

Title _____ Version Evaluated _____

Producer _____ Cost _____

Subject/Topics _____

Grade Level(s) (circle) pre-1 1 2 3 4 5 6 7 8 9 10 11 12 post-secondary

Required Hardware _____

Required Software _____

Software protected? ☐yes ☐no Medium of Transfer: ☐Tape Cassette ☐ROM Cartridge ☐5" Flexible Disk ☐8" Flexible Disk

Back Up Policy _____

Producer's field test data is available ☐on request ☐with package ☐not available

INSTRUCTIONAL PURPOSES & TECHNIQUES
please check all applicable

- ☐Remediation
- ☐Standard instruction
- ☐Enrichment
- ☐Assessment
- ☐Instructional management
- ☐Authoring
- ☐Drill and practice
- ☐Tutorial
- ☐Information retrieval
- ☐Game
- ☐Simulation
- ☐Problem Solving
- ☐Other _____

DOCUMENTATION AVAILABLE
circle P (program) S (supplementary material)

- P S Suggested grade/ability level(s)
- P S Instructional objectives
- P S Prerequisite skills or activities
- P S Sample program output
- P S Program operating instructions
- P S Pre-test
- P S Post-test
- P S Teacher's information
- P S Resource/reference information
- P S Student's instructions
- P S Student worksheets
- P S Textbook correlation
- P S Follow-up activities
- P S Other _____

OBJECTIVES ☐Stated ☐Inferred

PREREQUISITES ☐Stated ☐Inferred

Describe package CONTENT AND STRUCTURE, including record keeping and reporting functions

microSIFT COURSEWARE EVALUATION

NORTHWEST REGIONAL EDUCATIONAL LABORATORY

Package title _____ Producer _____

Evaluator name _____ Organization _____

Date _____ ☐ Check this box if this evaluation is based partly on your observation of student use of this package

SA - Strongly Agree A - Agree D - Disagree SD - Strongly Disagree NA - Not applicable
Please include comments on individual items on the reverse page.

CONTENT CHARACTERISTICS

(1)	SA	A	D	SD	NA	The content is accurate.
(2)	SA	A	D	SD	NA	The content has educational value.
(3)	SA	A	D	SD	NA	The content is free of race, ethnic, sex and other stereotypes.

INSTRUCTIONAL CHARACTERISTICS

(4)	SA	A	D	SD	NA	The purpose of the package is well defined.
(5)	SA	A	D	SD	NA	The package achieves its defined purpose.
(6)	SA	A	D	SD	NA	Presentation of content is clear and logical.
(7)	SA	A	D	SD	NA	The level of difficulty is appropriate for the target audience.
(8)	SA	A	D	SD	NA	Graphics/color/sound are used for appropriate instructional reasons.
(9)	SA	A	D	SD	NA	Use of the package is motivational.
(10)	SA	A	D	SD	NA	The package effectively stimulates student creativity.
(11)	SA	A	D	SD	NA	Feedback on student responses is effectively employed.
(12)	SA	A	D	SD	NA	The learner controls the rate and sequence of presentation and review.
(13)	SA	A	D	SD	NA	Instruction is integrated with previous student experience.
(14)	SA	A	D	SD	NA	Learning can be generalized to an appropriate range of situations.

TECHNICAL CHARACTERISTICS

(15)	SA	A	D	SD	NA	The user support materials are comprehensive.
(16)	SA	A	D	SD	NA	The user support materials are effective.
(17)	SA	A	D	SD	NA	Information displays are effective.
(18)	SA	A	D	SD	NA	Intended users can easily and independently operate the program.
(19)	SA	A	D	SD	NA	Teachers can easily employ the package.
(20)	SA	A	D	SD	NA	The program appropriately uses relevant computer capabilities.
(21)	SA	A	D	SD	NA	The program is reliable in normal use.

QUALITY

Write a number from 1 (low) to 5 (high) which represents your judgement of the quality of the package in each division:

____ Content

____ Instructional Characteristics

____ Technical Characteristics

RECOMMENDATIONS

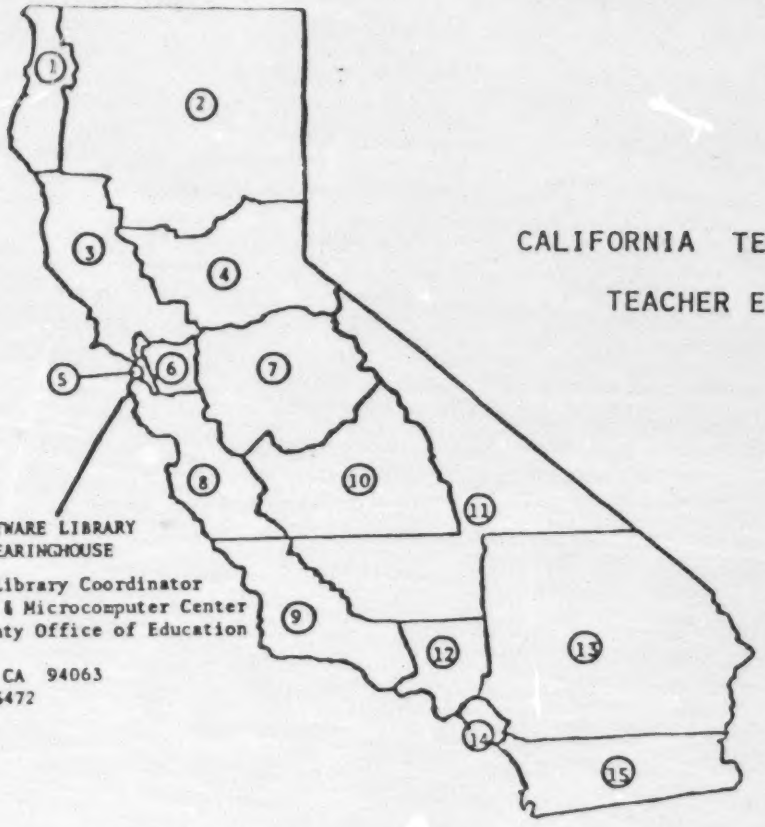
- ☐ I highly recommend this package.
- ☐ I would use or recommend use of this package with little or no change. (Note suggestions for effective use below.)
- ☐ I would use or recommend use of this package only if certain changes were made. (Note changes under weaknesses or other comments.)
- ☐ I would not use or recommend this package. (Note reasons under weaknesses.)

Describe the potential use of the package in classroom settings

Estimate the amount of time a student would need to work with the package in order to achieve the objectives:
(Can be total time, time per day, time range or other indicator.)

CALIFORNIA TEC CENTERS ::

TEACHER EDUCATION/COMPUTER CENTERS



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